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ELEMENTARY MATHEMATICS.

GEORGE W. MYERS.

SOME who are preparing to teach make the mistake of assuming that the tendency of modern education is to eliminate the mathematical work from the elementary curriculum. This mistake is probably due to hasty inferences from the overdrawn statements and criticisms of certain prominent schoolmen, who are not satisfied with the present outcome of current methods, and who are not careful to distinguish between good and bad teaching of mathematics. A very little study into the causes of those changes which have brought about most of the advances in the industrial world, which give to our time its peculiar character, will convince one that they are founded on the mathematical sciences. Economics and the so-called unmathematical sciences of zoölogy, botany, biology, etc., are being given more and more of a mathematical basis every day. This struggle is at times

carried even to extremes, but this only proves what is the direction of the struggle. The industries of engineering, architecture, etc., which are founded on mechanics, have always advanced hand in hand with mathematics. In short, the tendency of the changing demands of the problems of modern life is directly the opposite of what some assume it to be. Everywhere the mathematical requirements are being more strenuously insisted upon as a preparation for the real questions of the day. Moreover, in every educational institution where the training of men and women for efficient service is taken seriously, the tendency to give greater prominence to applied mathematical subjects is apparent. Teachers, most of all, need to bear this in mind, together with the fact that the special sort of attainment insisted upon is the power to *use the mathematics* in the *ordinary*, as opposed to the startling, affairs of life. Let no prospective teacher, therefore, who accepts the criterion of useful membership in society as a test of the educational value of school work, fail to read aright the omens of the times and to profit by the reading.

Contrary to common ideas and practice among those who are fitting themselves to teach, no subject can furnish the novice a better criterion of his progress toward fitness than does elementary arithmetic, if, indeed, any other subject can equal it in this respect. Pedagogical mistakes here become apparent both more quickly and more clearly than in what are sometimes called the "more nutritious" subjects of the curriculum. We need to remind ourselves at every turn, particularly when smarting under the consciousness of having failed glaringly in a number lesson, that, if mistakes are not revealed and consciously struggled against, they are seldom avoided in subsequent work.

And may we be permitted to inquire why and wherein subjects in which the imagination "runs riot" and in which the "facts in the case" are seldom, if ever, summoned to correct erroneous judgments, are really more highly nutritious than is a subject in which uneasiness is felt whenever violence is done to the facts? As used by too many who have habituated themselves to "spectacular" thinking, without applying to their conclusions the common tests for correctness, the term "palatable"

is suggested as a suitable substitute. Pronouncements upon the school subjects which are nutritious are too frequently like asserting that the saliva, gastric juice, and other agents of nutrition are of no great consequence in the nutritive process, but that all that is of importance is an abundance of food. It is unnecessary to push the comparison farther than to venture the suggestion that, when we come to see and to teach arithmetic aright, it will play very much the same part in education that the digestive fluids do in nutrition. When this is seen to be its true office, the reckless utterances of the "reformers" will be directed against more crying needs than the elimination of a subject whose worst offense consists in the fact that it makes rambling thinking and false statements seem just as unlovely as they are.

But the normal mind—the child's mind, when unhampered by *acquired* abnormalities—enjoys a reasonable contact with real things, which is another way of saying that the normal mind loves the truth without sugar coat better than with it. It is the distorted mind that must *gild* the truth *to make it* attractive. The normal mind discredits as guides to conduct all ideas which cannot stand before the test of facts, and it enjoys these ideas only for the relaxation they give—for the recoil from reality they furnish. Thus it is that rest and relaxation acquire whatever value they have from reality. We quite lose our bearings when we make the *unbending* the main thing in education and the *bending* merely something to be tolerated, because necessary, but to be kept within the narrowest limits. Those of us who are actively engaged in buffeting the waves of educational doctrine, while struggling nobly, but not always successfully, to steer our practice clear of most of it, must have a care lest some cool-headed layman, whose position of vantage gives him a truer perspective than we have, may show us some day that, with rare exceptions, the necessities of the child's environment, so far as nature has assorted it for him, are synonymous, not alone with his own best physical, moral, and intellectual good, but at the same time with a high degree of keen enjoyment.

One of the great advantages of the elementary number work

as a means of preparation of the young teacher is that as soon as the teacher begins to leave the route prescribed by the child's mind the fact is revealed by the listlessness, inattention, and erratic work of the pupil. The teacher cannot go far in the wrong direction until a halt is called by his own self-perceived shortcomings. Howsoever disquieting this may be to both teacher and pupil, it must be placed in the credit column of the inventory of advantages of arithmetic as a means of learning to teach.

Elementary teachers should also bear in mind that, justly or unjustly, more people will judge of their fitness for their work by the way they handle the number work and arithmetic than by any other single standard, even though they seek to evade being judged by this test by *proclaiming* some other subject as their "specialty." This is true, moreover, for the very reason that some teachers dislike to teach the subject, viz., that with number-teaching it is easier to devise a standard of testing the teacher's effectiveness and of applying the test to class-room practice.

Special attention is to be given during the present quarter to the preparation of teaching plans for the grade number work. Teachers will visit grades in their practice work and ascertain the subjects being taught. The number work of the professional classes will be based largely upon this work. It must be real number work and must tell something besides how to add, subtract, multiply, and divide—something besides the *way* of the process. If the pupils lack the facility needed to make the mechanical process a real tool, the necessary *drill must be given.* It is perhaps true that, if much of this need arises *from your teaching*, you are at least *in good degree* to blame.

The topics below are only suggestive. Topics the teachers select are by far the best, if they connect properly with the work the pupil is doing.

1. Plans for teaching topics relating to children's activities: (*a*) making; (*b*) modeling; (*c*) physical training.

2. Plans relating to the industries: (*a*) weaving; (*b*) excursions; (*c*) class-room work.

3. Plans relating to meteorological subjects: (*a*) temperature; (*b*) rainfall; (*c*) direction of wind.

4. Plans relating to study of woods: (*a*) strength of oak, ash, etc.; (*b*) strength depending on length; (*c*) strength depending on size.

5. Plans on the teaching of plants and leaves: (*a*) plants on a certain area; (*b*) leaves of a certain tree; (*c*) leaves of different trees.

6. Plans based on measurements in class-room: (*a*) sizes, heights, desks, tables; (*b*) blackboards, etc.; (*c*) drawing of floor plans.

7. Plans on study of trees: (*a*) sizes, heights; (*b*) angle of limbs; (*c*) those which shed their leaves.

8. Plans on topics connected with the motion of the sun: (*a*) daily changes; observe the sunny spots in the room; (*b*) sun as a time-keeper; (*c*) sun's motion along the meridian from day to day; (*d*) among the stars.

9. Plans on the study of insects: (*a*) butterflies, beetles, etc.; (*b*) colors; (*c*) habits and habitat.

10. Plans for the study of soil: (*a*) soil studied with reference to the use to which it is to be put; (*b*) with reference to the proportion of various kinds of soil.

11. Plans on experimental work, such as suggested in *Elementary Experiments in Observational Astronomy*.

12. Plans for teaching heating, ventilation; for studying foods, cookery, etc.

13. Number outline of each plan must be summarized: (*a*) for each grade; (*b*) with reference to number outcome; (*c*) with reference to operations to be learned; to applications.

14. Criticism and improvement of plans: (*a*) as to form; (*b*) as to extent; (*c*) as to completeness; (*d*) as to adaptability to purpose stated in the plan.

15. Reports on the teaching of the plans: (*a*) discussion as to further improvement; (*b*) was the development of the subject clear, correct, and rational? (*c*) criticisms of critic teachers.

16. Wherein did your teaching benefit the children intellectually? Morally? Physically?

17. What reason have you for believing that you really taught what you attempted? (*a*) Test of interest; (*b*) of pupil's ability to use what is supposed to have been taught; (*c*) what other tests can you apply to your own work?

ART IN RELATION TO HISTORY.

JOHN DUNCAN.

WHILE much of our art work — most of it we might say — together with our teaching of history, rises directly out of the students' experiences and in response to immediate practical needs, we also draw upon the past for inspiration and guidance in higher and apparently remoter concerns. We deal with the